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Standardized-care pathway vs. usual management of syncope patients presenting as emergencies at general hospitals

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Aims The study hypothesis was that a decision-making approach improves diagnostic yield and reduces resource consumption for patients with syncope who present as emergencies at general hospitals.
Methods and results This was a prospective, controlled, multi-centre study. Patients referred from 5 November to 7 December 2001 were managed according to usual practice, whereas those referred from 4 October to 5 November 2004 were managed according to a standardized-care pathway in strict adherence to the recommendations of the guidelines of the European Society of Cardiology. In order to maximize its application, a decision-making guideline-based software was used and trained core medical personnel were designated—both locally in each hospital and centrally—to verify adherence to the diagnostic pathway and give advice on its correct application. The 'usual-care' group comprised 929 patients and the 'standardized-care' group 745 patients. The baseline characteristics of the two study populations were similar. At the end of the evaluation, the standardized-care group was seen to have a lower hospitalization rate (39 vs. 47%, $P = 0.001$), shorter in-hospital stay (7.2 ± 5.7 vs. 8.1 ± 5.9 days, $P = 0.04$), and fewer tests performed per patient (median 2.6 vs. 3.4, $P = 0.001$) than the usual-care group. More standardized-care patients had a diagnosis of neurally mediated (65 vs. 46%, $P = 0.001$) and orthostatic syncope (10 vs. 6%, $P = 0.002$), whereas fewer had a diagnosis of pseudo-syncope (6 vs. 13%, $P = 0.001$) or unexplained syncope (5 vs. 20%, $P = 0.001$). The mean cost per patient and the mean cost per diagnosis were 19 and 29% lower in the standardized-care group ($P = 0.001$).
Conclusion A standardized-care pathway significantly improved diagnostic yield and reduced hospital admissions, resource consumption, and overall costs.

Introduction

Despite the development of several clinical guidelines,[1–5] current strategies for the diagnosis of syncope vary widely among physicians and among hospitals. Evaluation and treatment of syncope are often haphazard and unstratified. This results in an inappropriate use of diagnostic tests and in a high rate of misdiagnosed and still unexplained syncope. The consequence is over-utilization of medical resources and over-expenditure associated with syncope management.[6–10] If the status quo of syncope evaluation remains

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as it is, diagnostic and treatment effectiveness is unlikely to improve. Even implementation of the published syncope management guidelines is likely to be diverse, uneven in application, and of uncertain benefit. Although guidelines from scientific societies should set the standard, in our opinion, such guidelines are inadequately disseminated among medical practitioners and sometimes difficult to apply in clinical practice; moreover, physicians from specialties other than that which has drawn up the guideline may be reluctant to apply them to their patients. Thus, guidelines alone are unlikely to change significantly usual practice.

The Evaluation of Guidelines in Syncope Study 2 (EGSYS-2)[11] has recently validated a new method of syncope management on the basis of a decision-making approach developed in strict adherence to the recommendations of the guidelines of the European Society of Cardiology (ESC).[4,5]

In this controlled study, we tested the hypothesis that this new standardized method of care is superior to usual care in that it improves diagnostic yield and reduces resource consumption.

Methods

This study was a prospective, controlled, multi-centre study that compared, in patients presenting as emergencies at general hospitals, a new standardized method of syncope management based on a decision-making approach (standardized-care group) vs. a strategy of syncope management based on the generic implementation of guidelines (usual-care group).

Patients affected by transient loss of consciousness that, on initial evaluation, was attributed to syncope, and those in whom a syncopal condition could not be excluded (non-syncopal loss of consciousness) were included. Patients with a definite non-syncopal cause of loss of consciousness on initial evaluation, those aged <18 years, and those referred >24 h after their episode were excluded.

The protocol was approved by the Review Board of the participating hospitals listed in the appendix.

Standardized-care group

This group consisted of 745 patients attending the emergency services of all the 19 Italian general hospitals, which accepted to participate in EGSYS 2 from 4 October to 5 November 2004. In the validation study,[11] only the patients from 11 hospitals that enrolled consecutive patients had been included, for a total of 541 patients. All patients underwent diagnostic evaluation in strict adherence to the recommendations of the ESC guidelines.[4,5] In order to maximize its application, two main measures were taken: a decision-making software based on the ESC guidelines (EGSYS software, version 1.0) was used and a designated physician in each hospital participating in the study was trained. This physician interacted with a central supervisor with regard to the management of syncope according to the ESC criteria.

The EGSYS software is a web-based, on-line interactive decision-making system, developed to help the physician to follow the diagnostic pathway and the recommendations of the ESC guidelines. After logging-in, the authorized physician first filled in the initial evaluation form, which collected standardized data regarding patient's history, physical examination, including supine and standing blood pressure measurements, and standard electrocardiogram. Thereafter, physicians were asked whether loss of consciousness was attributable to syncope or to non-syncopal conditions and whether a likely diagnosis was possible on the basis of the information available. If a diagnosis was impossible at this stage, the software provided a list of clinical features suggesting a possible diagnosis, which needed to be confirmed by further tests. According to the features selected, the software suggested the appropriate diagnostic test and its interpretation. Once the evaluation had been completed and no cause of syncope could be determined, a re-appraisal form enabled the entire diagnostic process to be reviewed. When a likely diagnosis was reached, this was classified according to the ESC classification.[4,5] A 'help' command provided precise definitions from the guidelines to assist physicians with the appropriate pathway to be followed. Finally, data on hospitalization, resource consumption, and therapeutic strategy were collected. The EGSYS software was made available in an intra- and interhospital network in order to allow regular communication with all stakeholders (i.e. local and central investigators, clinical staff in the accident and emergency, cardiology, neurology, general medicine, geriatric medicine, etc.) and ensure a consensus for, and understanding of, proposed management strategies.

In each hospital, an investigator usually involved in the management of syncope was designated and instructed to run the study. Each day, the investigators were informed of every newly admitted patient affected by loss of consciousness, followed the subsequent diagnostic flow of the patients, and gave advice in order to maintain strict adherence to the standardized work-up. They were responsible for reviewing the patients' files and assigning the reported final diagnosis to one of the categories of the classification of loss of consciousness. Whenever discrepancies with the guidelines arose, they re-evaluated the case with central clinical monitors. The central clinical monitors, cardiologists who were experts in syncope management, had on-line access to the database. They supervised the entire process daily, verified adherence to the diagnostic pathway for all patients, and gave advice on any corrections deemed necessary.

The causes of deviation from the care pathway were pre-defined (protocol violation, incomplete evaluation, and incomplete records) and analysed, but these patients were also considered for analysis.

Usual-care group

The 929 patients aged ≥ 18 years of the Evaluation of Guidelines in Syncope Study 1 (EGSYS-1) database,[8] admitted to the emergency services of 28 general hospitals in Italy from 5 November to 7 December 2001, constituted the control group. As the aim of the EGSYS 1 study was to record the usual practice after the publication, in August 2001, of the ESC guidelines,[12] normal procedures were not influenced by laying down protocols and rules. In each hospital, an investigator collected the patients' records, followed the subsequent diagnostic flow of the patients, and recorded all the investigations performed until discharge; however, the investigator had no contact with the patients and had no role in clinical decisions.

In brief, as both EGSYS-1 and EGSYS-2 databases were founded on a common background, i.e. the ESC guidelines, they had common fields and used the same definitions and classifications, thus making their results comparable. Any differences in results could, therefore, be mainly attributed to different clinical practice.

Demographics and hospital requirements

All centres are large- or medium-sized public general hospitals, with a median of 150 000 inhabitants per district of referral (range 65 000–450 000). Each has a 24 h emergency department and a cardiology ward with a coronary care unit and on-site access to usual investigations and therapies for syncope. The 28 usual-care hospitals together serve a population of 4 951 648 inhabitants, which accounts for 8.7% of the total population of Italy. The 19 standardized-care hospitals together serve a population of 3 832 304 inhabitants, which accounts for 6.7% of the total population of Italy.

Study endpoint

The endpoint of the study was to compare the management of syncope (i.e. hospitalization rate, tests performed, and final diagnosis and costs) between the two study groups.

Patients who continued investigations after an unremarkable in-hospital work-up were followed-up (and data recorded) until a diagnosis was reached or for a maximum of 45 days. If a diagnosis was not reached within that period, the patient was classified as having unexplained syncope.

Statistical analysis and economic evaluation

Statistical comparisons of continuous variables between groups were performed by *t*-test or non-parametric test (Wilcoxon) for normal and not normal distributions, respectively. Comparison between proportions was by means of the χ^2 test. An economic evaluation was conducted to estimate the total cost per patient. The average daily cost of hospital stay was calculated by using the hospital accounting reports; the cost for in-hospital stay for each patient was estimated by multiplying the average daily cost by the number of days of hospitalization. The average cost of attendance at the Emergency Room was calculated from the accounting reports of the Emergency Room divided by the total number of admissions; this cost was arbitrarily considered the same for each patient referred. The cost of the tests was calculated on the basis of the tariffs set by the schedule of tariffs for outpatient services of the Italian National Health Service. The sum of the costs of the diagnostic tests performed on each patient was added to the previous costs to form the total cost per patient with syncope. The cost per diagnosis was calculated by dividing the total costs of patients referred for syncope by the number of final diagnoses made.

Results

The baseline characteristics of the two study groups were similar (*Table 1*). In the standardized-care group, adherence to the standardized decision-making approach was achieved in 584 patients (78%). The reasons for non-adherence in the remaining patients were patient refusal, protocol violation, incomplete evaluation, and incomplete records.

When compared with the usual-care group, the standardized-care group had a 17% lower hospitalization rate and an 11% shorter in-hospital stay (*Table 2*). Overall, 24% fewer tests were performed per patient, but the relative variations greatly differed among tests. Although there was a great increase in a few syncope-specific tests (e.g. exercise test, tilt testing, and electrophysiological study), there was a marked reduction in the use of less specific tests, such as carotid echo-Doppler, abdominal echography, computed tomography and magnetic resonance imaging, chest X-ray, basic blood chemistry, and so on (*Figure 1*). At the end of the evaluation, diagnoses of neurally mediated syncope and orthostatic syncope had increased by 41 and 66%, respectively, in the standardized-care group, whereas diagnoses of pseudo-syncope and unexplained syncope had decreased by 54 and 75%, respectively (*Table 2*). The mean cost per patient was 19% lower and the mean cost per diagnosis was 29% lower in the standardized-care group (*Table 3*).

Discussion

This study shows that a new standardized method of syncope management based on a decision-making approach significantly improved the overall diagnostic yield and reduced hospital admissions, resource consumption, and overall costs.

To date, only a few controlled studies have been performed. In the prospective, randomized, single-centre Syncope Evaluation in the Emergency Department Study (SEEDS),[13] a designated syncope unit in the emergency department improved diagnostic yield in that department and reduced hospital admissions for patients with syncope who were at intermediate risk of an adverse cardiovascular

Table 1 Characteristics of patients with loss of consciousness presenting as emergencies at general hospitals during the study period

	Usual care (28 hospitals)	Standardized care (19 hospitals)	*P*-value
Patients ≥18 years referred to ER for loss of consciousness	929	745	
Total no. of patients admitted to ER	105 173	84 900	
Incidence of syncope referred to ER	0.88%	0.89%	0.82
Mean number of patients enrolled per hospital	33 + 23	39 + 17	0.30
Mean age (years)	62 ± 21	66 ± 21	0.25
Median age (interquartile range)	69 (46–79)	71 (47–81)	0.19
Females	53%	50%	0.12
Comorbidities			
Hypertension	39%	42%	0.41
Structural heart disease	35%	37%	0.65
Diabetes	9%	9%	0.81
ECG abnormalities suggesting arrhythmic syncope according to the ESC guideline definitions[a]	26%	26%	0.77
History of syncope: first episode	66%	65%	0.14
Injuries related to fainting			
Major injuries (fractures and brain concussion)	8%	10%	0.12
Minor injuries (bruises, etc.)	21%	21%	0.98
No warning at the onset of the attack	33%	33%	0.86
Standing position at the onset of syncope	61%	63%	0.86

ER, Emergency Room.
[a]See recommendation for the ECG diagnostic criteria and Table 2.3 (ECG features suggesting cardiac syncope).

Table 2 Overall results

	Usual care $n = 929$		Standardized care $n = 745$		*P*-value
	Absolute no.	%	Absolute no.	%	
In-hospital pathway, number of patients					
Discharged from ER	496	53	456	61	0.001
Hospitalized	433	47	289	39	0.001
Internal medicine/geriatrics	273	29	176	24	0.008
Cardiology	91	10	75	10	0.853
Neurology	44	5	8	1	0.001
Other wards	25	3	30	4	0.128
In-hospital stay (days $\pm$ SD)	8.1 $\pm$ 5.9		7.2 $\pm$ 5.7		0.04
Tests performed, number of patients					
Electrocardiogram	880	95	745	100	0.001
Basic laboratory tests	726	78	263	35	0.001
Echocardiogram	170	18	120	16	0.239
Tilt testing	60	6	96	13	0.001
Carotid sinus massage	130	14	112	15	0.548
Prolonged electrocardiographic monitoring	215	23	84	11	0.001
Exercise test	11	1	23	3	0.006
Electrophysiological study	19	2	22	3	0.232
Coronary angiography	14	2	12	2	0.865
Electroencephalography	112	12	42	6	0.001
Brain CT scan and/or MRI scan	182	20	115	15	0.027
Carotid echo-Doppler	170	18	33	4	0.001
Chest X-ray	257	28	87	12	0.001
Abdominal echography	57	6	18	2	0.001
Miscellaneous (one or more test per patient)	184	20	99	13	0.001
Total number of tests[a]	3121		1912		
Median no. of tests per patient (interquartile range)	3.4 (3.1–4.0)		2.6 (2.1–3.0)		0.001
Final diagnosis,[b] number of patients	882		712		
Neurally mediated	410	46	466	65	0.001
Orthostatic	54	6	74	10	0.002
Cardiac	112	13	96	13	0.644
Cerebrovascular	14	2	0	0	0.001
Syncope-like conditions[c]	115	13	41	6	0.001
Unexplained syncope	177	20	35	5	0.001
Diagnosis not available (incomplete records/evaluation)	47		33		
In-hospital mortality, number of patients	10	0.1	6	0.08	0.50

ER, Emergency Room; CT, computerized tomography; MRI, magnetic resonance imaging.

[a]Total number of tests is superior to the sum of single tests because some patients repeated the same test, and one or more miscellaneous tests per patient were performed.

[b]According to the classification of loss of consciousness of the Guidelines of the European Society of Cardiology.[5]

[c]Syncope-like conditions include metabolic disorders (hypoglycaemia, hypoxia, hyperventilation), epilepsy, intoxications, transient ischaemic attack, cataplexy, drop attacks, and psychogenic 'syncope' (somatization disorders).

outcome. Patients randomized to the syncope unit underwent continuous cardiac telemetry for up to 6 h and hourly checks of vital signs and orthostatic blood pressure, and echocardiography for patients with an abnormal cardiovascular examination or ECG. Tilt-table testing and electrophysiological studies were performed in selected patients at the treating physician's discretion. However, in the SEEDS study, only 103 patients considered to be at 'intermediate' risk were enrolled, representing 2.9% of the patients with syncope who were screened and 40% of the patients who met inclusion criteria. As such, this was a study of a highly selected syncope patient population, and the results were not necessarily applicable to the majority of patients presenting with syncope.[14]

An EGSYS 1 substudy[15] compared six hospitals equipped with a syncope clinic organized inside the department of cardiology with six matched hospitals without such a facility. Although only a minority of emergency patients was referred to the syncope clinic, this did affect overall management, albeit modestly, resulting in fewer inappropriate examinations and a higher rate of diagnosis of neurally mediated syncope.

Diagnostic yield

The new method of management reduced the rate of diagnoses of unexplained syncope by 75% to a fairly low absolute value of 5%—much lower than the rates previously reported in the literature, which ranged from 13 to 54%.[7,9,10,16–22]

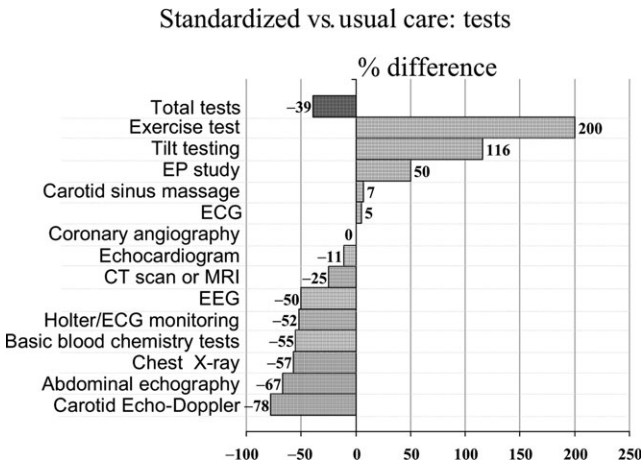

Figure 1 Per cent changes in test utilization in the standardized- vs. usual-care group. The absolute numbers are reported in *Table 2*. Please note that, for some tests (i.e. exercise test and EP study), a relatively small increase in absolute number reflects the greater percentage variation because of the small total number of those tests actually performed.

Table 3 Cost analysis

	Usual care ($n = 929$), euro	Standardized care ($n = 745$), euro	*P*-value
Total costs	1 295 000	839 449	
Hospital costs (%)	1 005 202 (78%)	633 149 (75%)	
Costs for tests (%)	289 789 (22%)	206 300 (25%)	
Cost per patient	1394 ± 1850	1127 ± 1383	0.0001
Cost per patient discharged from ER	180 ± 63	180 ± 75	0.88
Cost per patient hospitalized	2785 ± 2168	2621 ± 1878	0.001
Cost per diagnosis	1753 ± 2326	1240 ± 1521	0.0001
Cost per diagnosis per patient discharged from ER	226 ± 79	198 ± 83	0.001
Cost per diagnosis per patient hospitalized	3506 ± 2729	2880 ± 2064	0.0001

ER, Emergency Room.

Moreover, the mixture of diagnoses differed markedly between the two groups. For example, the increase in diagnoses of neurally mediated syncope was largely due to a shift to this diagnosis from one of syncope-like conditions—which is mostly a presumptive diagnosis—and from unexplained syncope. This shift was probably due to the systematic application of recommendations from the guidelines on the initial evaluation and the greater use of specific tests, i.e. tilt testing and carotid sinus massage. Again, the 66% rate of neurally mediated syncope observed was higher than those reported previously.[7,9,10,16–22] Conversely, the rate of cardiac syncope remained constant in the two study groups. Electrocardiographic abnormalities and the presence of structural heart disease are simple, sensitive (although not specific) widely used criteria that enable patients at risk of cardiac syncope to be identified.[23]

Tests

The new method of management required fewer tests. This confirms the common conviction that several superfluous tests are used in the management of syncope in usual practice. In particular, the use of all neurological tests markedly decreased in accordance with the recommendations of the guidelines[4,5] (*Figure 1*). Among cardiological tests, there was an increase in those more specifically able to determine a definite diagnosis (tilt testing, exercise test, and electrophysiological study). The decrease in electrocardiographic monitoring and echocardiography suggests an inappropriate overuse in usual practice.

Hospitalization and costs

Although a comparison of costs between different studies is difficult to perform, owing to differences in methods of calculation and differences between health-care systems in different countries, it is generally believed that the expenses associated with syncope management are high.[6–9,14,24,25] For example, it has been estimated that in the USA, the total cost of diagnosis and treatment for patients with syncope is $2.4 billion annually.[25] Extrapolating the data of the present study to the total Italian population and for an annual period, we estimated the total cost of evaluation of syncope for patients attending urgently at general hospitals as €178 917 000 under the usual-care regime. This estimate fell to €149 815 000 with the standardized approach described.

Hospital costs accounted for about three quarters of total costs in this study, as well as in others.[9,26] Thus, a major objective of the syncope management is to reduce the number of hospitalizations by offering the patient a well-defined, quick, alternative evaluation pathway.[4,5] In the present study, the reduction in the hospitalization rate in the standardized-care group was the main determinant of the observed reduction in costs per patient and per diagnosis (*Table 3*).

This is probably the first study that has been able to show a cost reduction through the implementation of a standardized protocol. Indeed, previous studies have shown an increase in costs with the implementation of guidelines. In one study performed in Italy,[26] an assessment of costs before and after the implementation of a hospital diagnostic pathway showed an increase from €3374 per patient before implementation to €3647 per patient after implementation; these higher costs were due to an increase in in-hospital stay and in the mean number of tests performed per patient. In another similarly designed study performed in UK,[9] the cost of investigation and hospital stay rose from £611 to £1384 per patient, with the cost per diagnosis increasing from £870 to £1949.

Limitations

We did not provide data on the follow-up or prognosis of syncope in order to confirm the diagnosis made at discharge because it is out of the scope of this study. Our patients received the proper evaluation recommended by the guidelines, which constituted the standard of reference.

The two study groups were compared on a historical basis and were not randomized. As only few hospitals were part of both groups, results could have been influenced by different characteristics of the hospitals involved in the usual-care and standardized-care groups. However, the hospital and patient characteristics were very similar (*Table 1*), thus suggesting a limited potential bias.

Cost estimations were rough and confirm that using less tests and less and shorter hospital stays reduces costs. However, this analysis will help the reader to quantify the cost of syncope evaluation and underlines that most of the costs are due to hospitalization itself; therefore, the major action of any efficient strategy should consider the reduction of inappropriate hospitalizations.

Conclusion

Although the results of this study are difficult to reproduce in everyday practice, the study shows that the ESC guidelines can be implemented in the clinical setting, provided that trained medical personnel are available and specifically designed decision-making software is used. In this study, we were able to achieve adherence to the standardized-care pathway in 78% of patients. Thus, these results support the creation of cohesive, structured syncope facilities, as in the model proposed by the ESC guidelines[4,5] or by others,[13] in order to provide optimal quality service on the basis of well-defined up-to-date diagnostic guidelines.

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Appendix

The following persons participated in the EGSYS study. Steering Committee—Alboni P, Ammirati F, Brignole M, Casagranda I, Cortelli P, Disertori M, Furlan R, Giada F, Iori I, Lagi A, Lunati M, Mathieu G, Menozzi C, Micieli G, Mussi C, Ponzi P, Raviele A, Re G, Ribani MA, Sandrone G, Scivales A, Ungar A; EGSYS 2 Database Production—Brignole M, Montagni M, Maggi R; EGSYS 2 Database Management—Montagni M; Central clinical monitoring—Department of Cardiology, Ospedali del Tigullio, Lavagna, Italy (Brignole M, Maggi R); Analysis of data—Scivales A, De Santo T; and Cost analysis—Scivales A, Ponzi P.

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